

U.S. Department  
of Transportation

**United States  
Coast Guard**



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# **SAFETY INVESTIGATION AND ANALYSIS GUIDE**

FOR U.S. COAST GUARD VESSEL  
AND FIREARM MISHAPS



**COMDTPUB P5102.1**





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SAFETY INVESTIGATION AND ANALYSIS GUIDE

LETTER OF PROMULGATION

1. PURPOSE. The Safety Investigation and Analysis Guide for Coast Guard Vessel and Firearm Mishaps is intended to assist Mishap Analysis Board and Unit Safety Board members with analysis of the causes of Marine, Marine-Related, and Firearm Mishaps under their jurisdiction.
2. DIRECTIVES AFFECTED. This guide supplements, but does not supersede, the mishap reporting and investigation procedures set forth in the Safety and Environmental Health Manual, COMDTINST M5100.47(Series).
3. DISCUSSION. Careful analysis of both mishaps and incidents of operational significance can help identify and correct causal factors, thereby reducing the likelihood and severity of future mishaps. This guide provides useful techniques which will help safety investigators to systematically analyze mishaps and identify their causal factors.
4. CHANGES. Your comments and suggestions are welcomed. Any comments should be addressed to Commandant (G-KSE-4).
5. GUIDE AVAILABILITY. Additional copies are available from Commandant (G-KRM-3).

*Michael Hudgins*

MICHAEL HUDGINS  
Chief, Office of Health and Safety

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**SAFETY INVESTIGATION**  
**AND ANALYSIS GUIDE**

**FOR USCG VESSEL  
AND FIREARM MISHAPS**

compiled by:  
Commandant (G-KSE-4)

FTS: 267-6863  
FAX: 267-4355  
COMM: (202) 267-6863  
E-MAIL: KSE-4/G-KSE



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## FORWARD

This handbook is published as a guide to assist with the conduct of Mishap and Incident (Near Mishap) Safety Investigations and Analysis on all classes of Coast Guard cutters and boats. It is intended for use by a Unit's Safety Board as well a Commandant-designated Mishap Analysis Board. It is beyond the scope of this guide to provide a complete course in professional accident investigation to the part-time investigator; however, the investigative techniques contained in this guide will help the part-time safety investigator to methodically conduct a thorough mishap analysis and determine the immediate, as well as basic causes, so that future mishaps may be prevented.

## AUTHORITY

This guide incorporates information gathered from current professional investigation practices and official directives in effect at the time of printing. *Material contained herein is not directive in nature and does not supersede official directives.* The Safety and Environmental Health Manual, COMDTINST M5100.47 (Series), establishes official requirements for investigating and reporting all vessel-related mishaps and incidents (near mishaps) which involve the Coast Guard. Additional requirements for reporting firearm-related mishaps are set forth in the Small Arms Manual, COMDTINST M8370.11(Series).



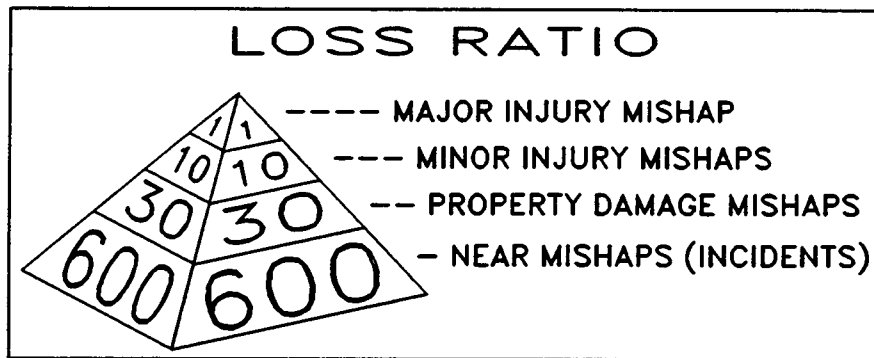
## 1. DEFINITIONS.

- a. ACCIDENT- For the purpose of mishap investigation, the term "accident" is synonymous with "mishap". The following two definitions apply equally:
- An undesired event that results in harm to people, damage to property or loss to process.
  - An unwanted transfer of energy, because of lack of barriers and/or controls, producing injury to persons, property, or process, preceded by sequences of planning and operational errors, which failed to adjust to changes in physical or human factors and produced unsafe conditions and/or unsafe acts, arising out of the risk in an activity, and interrupting or degrading the activity.
- b. ADMINISTRATIVE INVESTIGATION- A fact finding process conducted in accordance with COMDTINST M5830.1(Series). These investigations range from an informal one-man investigation to a formal Board of Inquiry. The primary purpose of such investigations is to provide convening and reviewing authorities with adequate information upon which to base decisions in the matters involved. Testimony provided in an administrative investigation may be taken under oath and can be used in other proceedings. Administrative investigations often parallel mishap safety investigations, but it is vital that they be conducted independently and by separate, autonomous parties.
- c. BARRIERS- The physical and procedural measures to direct energy into wanted channels and to control unwanted release.
- d. BASIC/UNDERLYING CAUSE- Causal Factor.
- e. CAUSAL FACTOR- Any event or condition in the accident sequence necessary and sufficient to produce an unwanted result.
- f. CVSB- The Commandant's Vessel Safety Board is convened by Commandant to review serious mishaps and major safety issues, and to make appropriate recommendations.
- g. INCIDENT- An undesired event which, under slightly different circumstances, could have resulted in harm to people, damage to property or loss to process; A near mishap.
- h. IMMEDIATE/DIRECT CAUSE- The final substandard/unsafe act or condition in an accident sequence which allows an unwanted transfer of energy, causing a mishap.

1. i. NEAR MISHAP- An incident which could have resulted in a mishap, but through intervention or chance did not; An incident.
- j. MAB- See "Mishap Analysis Board".
- k. MISHAP- Any unplanned or unexpected release of energy causing personnel injury, occupational illness, death, or material loss or damage. Also, an explosion or unplanned firearm discharge of any kind, whether damage occurs or not; see "Accident".
- l. MISHAP ANALYSIS BOARD- A formal safety investigation team appointed by Commandant to analyze selected class A and B mishaps.
- m. MISHAP BOARD- For the purpose of this manual, this term is used interchangeably to refer to either a mishap analysis safety investigation directed by a Unit Safety Board, or a formal Mishap Analysis Board appointed by Commandant.
- n. MISREP- A Coast Guard Mishap Report, as required by the Safety and Environmental Manual, COMDTINST M5100.47(Series).
- o. NTSB- National Transportation Safety Board.
- p. REAL EVIDENCE- Physical and factual evidence. Examples include photographs, operating logs, pertinent directives, parts of damaged equipment, etc. Real evidence may be shared with other official investigative bodies, including the NTSB, administrative investigations (Formal/Informal/Board of Inquiry), NJP proceedings, etc. Real evidence does not include statements made by witnesses or the opinions of investigators.
2. GENERAL. The purpose for conducting safety mishap investigations is often misunderstood. It is not to assess blame for disciplinary and/or administrative purposes. A good safety mishap investigation will be only a fact-finding and not a fault-finding process. A poorly conducted investigation may only identify the immediate causes and often degenerates into a fault-finding exercise; This is not likely to determine the real causes of what happened nor offer any effective solutions to prevent future mishaps.
  - a. An effective mishap investigation will help to:
    - (1) Describe what happened. A good investigation will sift through all the conflicting evidence and develop an accurate picture of what really happened.

2. a. (2) Determine the real causes. The immediate causes of a mishap are often obvious, but they seldom reveal the underlying basic causes that allowed a sequence of events to lead to a mishap.
- (3) Decide the risks. A good investigation will help to predict the likelihood of recurrence and identify the potential for a major loss.
- (4) Develop controls. A thorough investigation will identify deficiencies in materials, programs, policies, procedures, and training and will suggest long-term solutions to minimize future loss potential.
- (5) Define trends. A thorough analysis of reported mishaps in the Coast Guard's mishap data base will identify emerging trends.
- (6) Demonstrate concern. We all bear a responsibility to look out for our shipmates. Prompt investigations are reassuring to those who are at risk from further mishaps and they show our genuine concern to maintain a safe working environment.
- b. When to Investigate. The criteria for determining which mishaps and incidents must be reported are set forth in the Safety and Environmental Health Manual, COMDTINST M5100.47(Series). If a mishap or incident does not meet these reporting requirements it does not mean that a safety investigation is unnecessary. Mishap safety investigations should be conducted for even minor mishaps if they will yield valuable lessons to prevent a recurrence. In addition, any incidents which have a high potential (HI-PO) for loss should be investigated. Was a chance occurrence the only reason that a steering casualty didn't result in a collision, or that a fuel leak was discovered before creating a major spill or fire? These incidents need to be thoroughly investigated before they are repeated in the form of serious mishaps. Many minor mishaps or incidents can be briefly investigated by the immediate supervisor without the need of a formal report.
- c. Importance of Investigating Near Mishaps. For every major injury mishap there are approximately 600 incidents with the potential of becoming mishaps. Typical accident ratios are illustrated in Figure 2-1. By analyzing the

2. c. (cont'd) significant incidents and acting on the lessons learned, we can reduce the occurrence of serious mishaps.



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Figure 2-1

3. **MISHAP TYPES.** Mishaps involving the operation and maintenance of Coast Guard cutters, small boats, and firearms are defined by types and divided as follows:
- a. **Marine Mishap.** A mishap in which a vessel is underway or at anchor. This includes docking or undocking with the propulsion system energized.
  - b. **Marine-Related Mishap.** A mishap in which a vessel is moored to a fixed structure while in a standby or maintenance and repair status, or when a vessel is removed from the water (cradled, drydocked, or in a marine railway). The vessel boundary includes the gangway, shore ties, and mooring lines to their attachment on shore.
  - c. **Firearm Mishap.** A mishap involving the unintentional discharge of a firearm or an intentional discharge that involves unintentional injury, fatality, or damage. Firearms mishaps are of four types: operational, training, test, and recreational.
  - d. **Other Mishaps.** Unless firearms are involved, aviation and shore facility mishaps are not addressed by this publication. Refer to COMDTINST M5100.47(Series) for guidance.
4. **MISHAP CLASSIFICATION.** Mishap types are subdivided into four classifications according to the severity of injury, damage, or loss. Once the injury, damage, or loss is estimated/determined for the mishap, a classification should be assigned and the investigative and reporting action should be initiated. The four classifications of cutter, small boat, and firearm mishaps are as defined in COMDTINST M5100.47(Series).

5. VESSEL MISHAPS OF DOUBTFUL CLASSIFICATION. Occasionally, there will be doubt as to the proper classification of a mishap. If doubt exists, the mishap should be classified as the higher of those under consideration and the appropriate procedures followed. Commander (k), MLC or Commandant (G-KSE-4) should be contacted as soon as practicable for assistance in determining proper classification. The final classification will be made by the Commandant's Vessel Safety Board upon review of the final report for class A and B mishaps. Commander (k), MLC will make the final classification for class C and D mishaps.
6. VESSEL MISHAPS THAT ARE REPORTABLE EVEN THOUGH NO INJURY, OCCUPATIONAL ILLNESS, OR PROPERTY DAMAGE IS SUSTAINED. Incidents with a high potential for loss to people, property, equipment, environment, or mission capabilities that result in NO DAMAGE, may at the discretion of the CO or OPCON, be reported as class D mishaps. The following events are examples of reportable events. The list, however, is not all-inclusive.
  - a. Emergency breakaway is carried out while conducting towing or underway replenishment/fueling at sea.
  - b. Near collision.
  - c. Forced docking, towing, or anchoring of a CG vessel caused by a system/component malfunction or failure.
  - d. Fouled propellers.
7. EVENTS NOT REPORTABLE AS VESSEL MISHAPS.
  - a. Damage Due to Testing. Damage resulting from the intentional destructive testing of cutters, small boats, or firearms for research and development purposes.
  - b. Damage Due to Enemy Action. Vessels damaged or missing as the result of enemy action.
  - c. Normal Wear and Tear. Malfunction or failure of components discovered during maintenance or inspection that are normally subject to fair wear and tear and have a fixed useful life, provided the malfunction is the sole cause of damage. Minor cracks, breaks, wrinkles, and ruptures will be considered fair wear and tear within the meaning of this paragraph.
8. DETERMINATION OF MISHAP COSTS. The direct cost of a vessel mishap is the total cost of fatalities, injuries, occupational illnesses, Coast Guard property damage, and

8. (cont'd) non-Coast Guard property damage resulting from Coast Guard operations. Only direct costs are to be used in determining mishap damage costs. Costs for transportation, temporary additional duty, setting up equipment to facilitate repair, etc., are not direct costs and will not be included in the total damage cost estimate. The following guidelines should be used for mishap cost determinations:
- a. Destroyed, Missing, or Abandoned Vessel Cost. This cost should be obtained from the program or facility manager at the MLC or Commandant level.
  - b. Coast Guard Property Damage. This will include the actual cost of parts and direct man-hours. Parts costs will include the cost of replacement for damaged or destroyed parts or the cost to repair the damaged parts. Work-hours costs are to be computed at the standard rate per work-hour. Work-hours not included in vessel mishap costs consist of time used in setting up equipment preparatory to actual repair of the vessel and work-hours used in removing, replacing, and inspecting undamaged parts and components solely to satisfy technical manual inspection requirements. Direct work-hours include:
    - (1) Cumulative work-hours required to remove, repair, and replace damaged equipment.
    - (2) Work-hours required to restore the vessel to serviceable condition, if economically repairable.
    - (3) Work-hours required to remove and replace undamaged components to remove, repair, or replace damaged assemblies, subassemblies, and/or components.
    - (4) Work-hours required to remove and replace a part if the part is not economically repairable.
  - c. Replacement of Damaged Components. Removing a damaged component and replacing it with a new or used component to decrease the work-hours required and costs for purposes of mishap classification is prohibited. If a like component is installed so that a vessel is available for operations, the best estimated work-hour costs to remove, repair, and replace the damaged component should be used for mishap classification.
  - d. Cost of Non-Coast Guard Property. The cost of non-Coast Guard property will be the best estimate to repair or replace it.
  - e. Cost of Injury and Illness. Use the cost data contained in COMDTINST M5100.47(Series) to compute the cost of death, injury, and occupational illness to Coast Guard personnel.

8. f. Damage Not Included in Vessel Damage Cost Computations:

- (1) Damage incurred under the conditions described in paragraph 7.c. (normal wear & tear) should not be included in cost computations unless a malfunction or failure of a component causes damage to another component.
- (2) Damage caused by salvage operations or firefighting operations. If damage occurs in transportation, or as a result of salvage operations or firefighting, this damage should be assessed and reported in the Coast Guard Mishap Report and the final Formal Mishap Analysis Report.

9. MEDICAL OFFICER'S REPORT. A Medical Officer's Report will be generated for all Class A and B mishaps, and for other mishaps at the discretion of the CO or Operational Commander. This report is important to allow for analysis of human factors and is made a part of the official Mishap Analysis Report. The requirements for this report are detailed in COMDTINST M5100.47(Series).

10. TYPES OF SAFETY INVESTIGATIONS.

- a. Unit Safety Board Investigation. This investigation is conducted under the direction of the Unit Safety Board and is the precursor to any Commandant-convened Mishap Analysis Board (MAB). Its purpose is to determine all causal factors, to identify corrective actions, and if necessary, to preserve evidence for any MAB investigation. A unit safety board may direct the investigation of any mishap or incident that it feels is significant, regardless of whether or not it is reportable. Unit safety investigations may be composed of any number of individuals who possess the technical expertise to analyze a mishap or incident. The investigation does not need to be conducted by the safety board itself. However, the investigative team should include at least the workplace first-line supervisor because that person has control over the scope of the mishap (as well as any future corrective measures). The Unit Safety Supervisor should be consulted for assistance with the administrative details of this investigation.
- b. Mishap Analysis Board (MAB) Safety Investigation. The Mishap Analysis Board is appointed by Commandant to analyze class A and B mishaps. It may consist of one or several members who possess the expertise necessary to analyze a particular mishap. Since the MAB may not arrive on-scene until several hours or days after a mishap, the unit should do its best to preserve evidence, locate witnesses, and conduct a preliminary

10. b. (cont'd) investigation in preparation for the arrival of the MAB. It is important that the Unit's preliminary mishap report be as complete as possible, as this will help Commandant to determine the need for, and composition of, a Mishap Analysis Board.
- c. Independent Mishap Analysis Board. Commandant (G-KSE) may elect to conduct an independent analysis of certain mishaps and incidents of safety concern. Such an analysis may be conducted in lieu of, or in addition to, the regular analysis. Commandant (G-KSE) shall determine the composition of these boards and will be the appointing authority.
- d. National Transportation Safety Board (NTSB) Investigation. A National Transportation Safety Board investigation may be conducted for any mishap involving a Coast Guard unit and a non-public party.
- (1) The Marine Safety Manual contains a memorandum of understanding between the Coast Guard and the NTSB regarding accident investigations. This agreement provides for the NTSB to be notified of certain incidents involving the Coast Guard and non-public vessels when a fatality has occurred, property damage exceeds \$75,000, or in other instances as specified in the agreement. It also provides for the Coast Guard to be included in certain NTSB investigations as specified in 49 CFR 831.9, 49 CFR 850, and 46 CFR 4.40.
- (2) When assigned as members in an NTSB investigation, Coast Guard representatives will generally follow the NTSB protocol. However, this will never deter Coast Guard members from steadfast participation in NTSB investigations to ensure that all Coast Guard issues are properly addressed.
- e. Joint-Service Mishap Investigation. In the event of a mishap involving both a Coast Guard vessel and a United States military vessel from another service, a single joint mishap analysis board may be convened for expediency if considered appropriate by both Commandant and the commander of the safety center of the other armed service. Each service should be represented on Joint Mishap Boards. Selection of members and appointment of the senior member will be by mutual agreement between Commandant (G-KSE) and the commander of the safety center involved. The proceedings of a joint board should be recorded in Coast Guard format. The other service may format their own report as desired.
- f. Appendix B illustrates the distinctions between the different types of mishap investigations.



11. APPOINTMENT AND CONVENING OF MISHAP BOARDS. Mishap boards should be appointed as soon as practicable to analyze each Coast Guard mishap as well as each incident that, in the opinion of the CO or OPCON, has a high potential to harm people, damage property, or degrade mission readiness.
- a. Commandant (G-KSE) will be the appointing and convening authority for all class A and class B Mishap Analysis Boards. Under unusual circumstances, Commandant (G-KSE) may delegate this responsibility to the reporting custodian or an officer in the chain-of-command senior to the CO/OIC. These boards may vary in composition according to the seriousness of the mishap.
  - b. The reporting custodian will normally be the appointing and convening authority for class C and class D mishaps. At a minimum, the CO should appoint a mishap board to investigate and analyze class C and D mishaps.
12. COMPOSITION AND SELECTION OF INVESTIGATORS. Selection of personnel to conduct a mishap investigation warrants careful consideration. Mishap Boards may be comprised of one or several members drawn from the Unit, District, MLC, or Area level, depending on the complexity of the incident and the needs of the investigation process.
- a. Generally, class A and class B mishap boards are comprised of the following membership:
    - (1) Senior Member. The senior member should be senior to the CO involved in the mishap and familiar with the class of vessel or evolution involved.
    - (2) An Engineering Member familiar with the class of vessel involved.
    - (3) A Flight Surgeon or Medical Officer.
    - (4) Other Members. Other knowledgeable officers or technicians may be assigned as conditions warrant.
  - b. Class C and class D mishap boards will normally consist of at least one member. A medical representative should be assigned to mishap boards that investigate injuries or human factor events to crew members and/or passengers.
  - c. The Unit Safety Supervisor need not be a member of the Mishap Board, but he/she should provide all possible assistance in assuring command and administrative support.
  - d. Investigators should possess high integrity and be able to maintain complete objectivity. In the Unit's initial

12. d. (cont'd) investigation, it is a good practice to include the first-line supervisor since this person has overall authority over the incident and a vested interest in determining the basic causes. In addition, the first-line supervisor is in the best position to take interim corrective measures. However, it is natural for supervisors to be protective of their own self-interests if they fear they share fault. Remember, a safety investigation is a "fact-finding" and not a "fault-finding" effort.
- e. It is important that an investigator possess the perseverance to trace each symptom back to the basic cause. Basic causes are usually not the immediate and obvious causes of an incident; they may be rooted in inadequate programs, inadequate standards, or lack of compliance with existing standards, policies, and practices.
- f. Technical skills of investigator candidates should be considered. Expertise may be needed in deck seamanship, operations, engineering, weapons, or some other specialty. At the request of the senior member, additional Coast Guard or other military/civilian personnel may be assigned as observers/technical experts to assist the investigation. An invited observer will not be a member of the board, but may participate in the board's investigation and analysis to the extent considered warranted by the senior member of the board. Requests for observers should be addressed to Commandant (G-KSE). Security classifications must also be considered when classified information is involved.
- g. Members from other services, Flight Surgeons or Medical Officers may be assigned as board members as appropriate.
- h. The leading investigator must have full command support and possess the motivation and leadership skills needed to conduct an in-depth investigation.
- i. Members of the Mishap Board shall not be assigned as members of any other board conducting an investigation into the same mishap, and vice versa.
- j. Personnel who are directly involved in the mishap cannot serve as members.

13. CONFIDENTIALITY OF INFORMATION PROVIDED TO MISHAP BOARDS.

- a. All mishap investigators must familiarize themselves with the limitations on the use of mishap investigation information, materials, reports, and analysis. Much of the information obtained in a mishap investigation, whether conducted by the Unit or a Commandant-appointed Mishap Analysis Board, is privileged and may not be

13. a. (cont'd) shared with other investigative bodies. The Safety and Environmental Health Manual, COMDTINST M5100.47(Series), and the Administrative Investigations Manual, COMDTINST M5830.1(Series) should be consulted for guidance as to which evidence and information may or may not be shared.
- b. No statements regarding specific instances or Coast Guard practices should be given to potential claimants or their attorneys without first consulting with the appropriate Coast Guard legal office.

14. STEPS IN THE INVESTIGATION.

- a. Ensure that all Immediate Response and Control Measures have been taken. This is important in order to stabilize the scene, prevent further damage/injury, and preserve the accident site for proper investigation. As soon as the situation permits, refer to the unit's Pre-Mishap Plan for unit-specific guidance.
  - (1) Someone must immediately assume charge and take control at the scene.
  - (2) Emergency response teams should be dispatched.
  - (3) Personnel casualties should be removed from hazardous areas and first aid rendered.
  - (4) Immediate casualty control measures should be implemented to prevent further loss.
  - (5) Conduct damage control procedures as needed to safeguard personnel and equipment.
  - (6) Protect classified materials from compromise.
  - (7) Nonessential personnel should be directed to stand clear.
  - (8) As soon as the situation permits, isolate affected areas, restrict access, and protect evidence from unnecessary disturbance. Well-meaning supervisors will be anxious to investigate on their own, but in doing so may inadvertently alter important evidence before it's condition and location are properly documented. Operational needs may make it vital to restore normal operational capabilities as soon as possible; This may preclude any attempt to preserve the conditions at the scene. However, the desire to expedite repairs must be carefully weighed against the possible alteration or loss of evidence when the mishap scene is disturbed. If possible, obtain several photographs of the mishap scene prior to disturbing anything.

14. a. (9) Wreckage and real evidence should be preserved in a secure and proper custody chain. It may later be required for various investigative bodies, analysis, and possible legal proceedings. Refer to COMDTINST M5100.47(Series), and COMDTINST M5830.1(Series), and paragraph 16 of this publication for further guidance.
- (10) Notify appropriate authorities that a mishap has occurred. Reporting criteria is prescribed in the Safety and Environmental Health Manual, COMDTINST M5100.47(Series). An immediate telephone or message report to Commandant (G-KSE) is required for all Class A/B mishaps, as well as those expected to generate high publicity from the news media. Message reports of all Class A and Class B mishaps and other operationally significant mishaps should add AIG 4923 and AIG 4934 as information addressees.
- b. Flight Surgeon/Medical Officer/Medical Department Activities. Class A/B mishaps, and Class C/D mishaps where human physiological factors are suspected, will normally require medical support to develop the Medical Officer's Report and conduct human factors analysis.
- (1) The first Medical Officer on a mishap scene, or the one to whom mishap victims are brought, should perform examinations and laboratory procedures needed for the Medical Officer's Report Format as soon as possible. Procedural requirements are specified in COMDTINST M5100.47(Series). Survivors should be examined and treated by a Medical Officer, preferably a Flight Surgeon, at the earliest opportunity.
- (2) Blood and urine tests are required for all class A and class B mishaps, for class C and class D mishaps if human physiological factors are suspected, or as directed by the CO or Operational Commander. These tests should be initiated soon as possible after the mishap. Laboratory tests are listed on Form A, Section II of the Medical Officer's Report as described in COMDTINST M5100.47(Series). Label the specimens with name, SSN, date and time taken. Specimens should be frozen as soon as possible and iced until they can be frozen. Samples needed from each person are as follows:
- (a) Blood- Two "red top" tubes (10 ml. each).
- (b) Urine- Minimum of 50 CC's.

14. b. (3) Examinations will be recorded and reported by the Medical Officer using his/her own service's reporting forms. Examinations should be as complete as the examinee's condition and other circumstances permit.
- (4) Additional testing after an accident may also be required for civilian employees. Consult COMDTINST M5100.47(Series) and the applicable civilian personnel office.
- (5) All personnel involved in class A and class B mishaps should receive a complete physical examination by a military Medical Officer prior to returning to full duty. This examination should be recorded on Standard Forms 88 and 93, and these forms should be included in the Medical Officer's Report.
- (6) Remains of deceased members should be taken into custody, covered, protected, and, if possible, transported to a safe holding area until released to the custody of the Medical Officer. Do not allow remains to be photographed by non-investigative persons. The remains of deceased members must be treated with the utmost dignity.

c. Collect Pertinent Information. Try to get the overall picture of what happened and then ask yourself some fundamental questions: What appears to have happened? Who needs to be notified? Who needs to be interviewed? What equipment, tools, materials, or people are missing that should be there? What is present that should not be? What things may have failed or malfunctioned? What procedures were involved and what are the governing directives? What do you need to know about training, repair, maintenance, and other things that may be in records? Do not be too quick to develop conclusions which limit your initial research to a very narrow area. Remember that most mishaps are the result of a sequence of related events, not just one obvious cause.

- (1) Obtain photographs to preserve the location and condition of evidence before anything is relocated. Photos with sufficient clarity to depict conditions/situations are invaluable as evidence. If possible, take both color and black and white photographs. While color photos usually depict the best pictorial descriptions, the higher contrast of black and white photos can reveal minute details such as scratches and dents that would not be apparent in color. Polaroid photos are less preferable because of their poor reproduction and enlargement characteristics. Photographs should be taken from at least two angles, both close-up and far away, and should also

14. c. (1) (cont'd) include a ruler or some other means to show scale. If high-quality photographs are essential consider the services of a Photo Journalist or professional photographer, but remember that they will need very specific guidance in determining what to photograph. Video recordings can be invaluable to record actions leading up to, and immediately following, a mishap but are seldom in use when a mishap occurs. Due to their low resolution and poor reproduction of still images, video recordings are of limited value for recording a scene after a mishap.
- (2) Make sketches. Sketches can be quite revealing when it is important to precisely locate positions and to show relative movements of people and equipment (energy transfers). Sketches can also eliminate unnecessary clutter, thereby showing key elements more clearly than photographs. It is best to make scale drawings on graph paper. Use at least two fixed reference points to determine the exact positions of objects.
- (3) Collect or record the condition of relative parts/material/equipment. Evidence at the scene must be carefully handled to ensure that it is not altered or destroyed and to preserve the custody chain if legal proceedings are anticipated. Simply changing the position of a switch or wiping up a fluid leak could hide important clues that may never be revealed. Prior to disturbance, a photo, video, sketch, or other record should be made to depict each item's "as found" condition and/or location. Each item should be tagged with a full description of it's relationship to the mishap. Compare equipment condition with established standards (i.e. technical manuals, placards, markings, preventive maintenance system (PMS), etc.). Items which must be sent to an MLC or other location for analysis should be packaged with care to protect evidence and shipped via registered mail to establish custody.
- (4) Collect or obtain copies of any logs, directives, or records that may yield significant facts. These may include the Ship's log, navigation log, bell log, weather log, voice radio log, visual signalling log, engineering log, telephone logs, machinery logs, machinery history, hull history, damage control message blanks, plots on damage control diagrams, message traffic, video recordings, photographs, blue prints, manuals, etc. Look for any deviations from standard procedures or conditions (i.e. structural changes that are not reflected on ship's drawings, missing or deficient operating procedures, incomplete PMS, etc.)

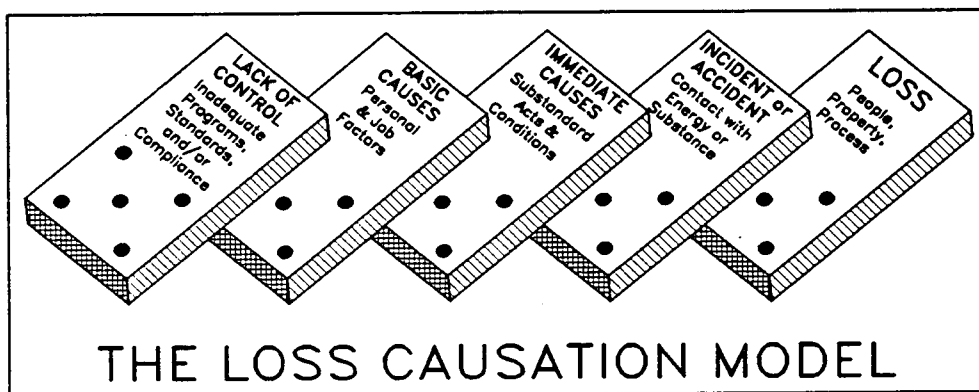
14. c. (5) Locate all possible witnesses and interview as many as necessary to obtain complete information. This can be done through personal interviews, by checking watch records, and by considering all areas where witnesses may have been present. Consider where each witness was positioned at the time and what he/she could observe from that particular vantage point.
- (a) Interviews should be conducted as soon as possible following the mishap. When events are still fresh in the witness's minds they will contain maximum details and are more complete and reliable.
  - (b) Witnesses should be interviewed separately and, if possible, prevented from exchanging opinions among themselves until after they have given their statements. This is important to prevent them from "contaminating" their initial perceptions with the theories of others. It is up to the investigator to recognize the differences in eyewitness accounts and to resolve those discrepancies based upon the collective evidence.
  - (c) Put the witness at ease. Try to interview in a "neutral" and private setting where they won't feel threatened or be distracted. Try to get on equal terms with the witness and don't be overbearing. Assure him/her that testimony provided to the Mishap Board is voluntary and is not taken under oath; Per COMDTINST M5100.47, Para. 3-J-6, statements made to the safety investigation cannot be used for any other investigation or legal proceedings. The Mishap Board's purpose is to identify all causal factors for the purpose of reducing future mishaps, and not to assess blame.
  - (d) Get the individual's version. You do not want his/her testimony to be tainted by the suggestions of you or others. Ask "In your own words, what did YOU see/hear/smell?", "What is YOUR knowledge of the procedure?", etc. Consider that each individual may have some biases.
  - (e) Be a good listener. Encourage the witness to tell the story in his/her own way and without frequent questions, comments, suggestions, or other interruptions from the interviewer. Try to keep the witness talking but allow periods of silence for the witness to collect his/her thoughts. Important details may be omitted if the witness feels pressured to get on with the story.

14. c. (5) (f) Ask necessary questions at the right time. Prompt for more detail to answer important questions that come to mind during the interview, but do not interrupt unnecessarily. Avoid "leading" questions or those that require only a "yes/no" answer. Do not put words in the witness's mouth.
- (g) Give the witness some feedback. Repeat key points as you understand them.
- (h) Good note-taking will help you to later piece the facts together and it shows the witness that you are interested in what he/she has to say. Record key points quickly but try not to be so absorbed in note-taking that you lose eye-contact with the witness. It is generally not advisable to take audio or video recordings during an interview, as this tends to make most witnesses less candid. If a recording device is used, the contents must be protected from unauthorized disclosure and witnesses must be made aware of it's presence.
- (i) Consider using visual aids such as navigation charts, sketches, or pieces of actual equipment to develop clearer understanding of the mishap. When practical, conduct interviews at the mishap scene to allow for more descriptive witness accounts.
- (j) Set the atmosphere for follow-up. Ask the witness if he/she has anything else to add and ask to be notified if any significant thoughts are later recalled. Explain that witnesses may be interviewed again if follow-up questions are needed.
- (6) Reenactments are generally NOT recommended, as they can easily cause a repeat of the mishap. If a reenactment is considered necessary it must be conducted very carefully and under fully controlled circumstances. Each action should be described before it is carried out and then performed only if approved by safety observers and under their continual observation. The reenactment should be stopped prior to performing any hazardous act and as soon as the necessary information is obtained.
15. ANALYZING EVIDENCE. There are several techniques which may be used to determine the causes of an accident. Each technique could itself be the subject of a lengthy course of instruction, but highlights of some of those methods are presented in the hope that they will provide some direction



15. (cont'd) in how to analyze an accident and arrive at the basic causes. Do not rely on any single method to provide a full analysis. Several of the techniques discussed here may be used to compliment each other.

- a. Loss Causation Model. To fully understand the causes of a mishap or incident, it is useful to start with the loss and break events down to their key elements in reverse order. This is illustrated by the Loss Causation Model shown in Figure 15-1.



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Figure 15-1

- (1) Start by identifying the Loss(es) to people, property, or process (e.g. death, injury, lost or damaged vessel, machinery casualty, degraded mission capability, etc.). It may be necessary to develop a separate model for each loss. If this was an incident, rather than a mishap, identify the hi-potential loss.
- (2) Next, identify the contact with energy or substance that created the loss (e.g. fell down ladder, ran aground, contact with electricity, etc.). If this was an incident and no contact occurred then identify the near contact.
- (3) Identify the immediate cause(s) that allowed the contact to occur. These are substandard acts and substandard conditions (e.g. failure to follow established procedures, inadequate barriers, lack of safety equipment, noise exposure, fire hazard, etc.).
- (4) Once the immediate cause(s) have been identified ask "Why?" for each cause. Asking "Why?" will help you to identify the basic causal factors, rooted in personal factors and job factors, that led to the substandard acts and conditions (e.g. lack of skill, improper motivation, inadequate supervision, inadequate maintenance, etc.)

15. a. (5) Finally, look for any lack of controls that permitted the accident sequence to start (e.g. inadequate program, inadequate program standards, inadequate compliance to standards).

b. Material Failure Analysis. This is simply an examination of materials to determine how they failed and, hopefully, what caused the failure. Most vessels have the on-board expertise to conduct simple in-house examinations. When a more thorough analysis is desired than the unit can provide (e.g. microscopic studies, magnetic flux inspection, metallurgical analysis, determination of breaking forces involved, etc.), outside assistance is available from several sources such as MLC, Coast Guard Yard, other government facilities, or private contractors.

c. Energy Trace and Barrier Analysis. This is a technique used to identify all forms of energy relating to a mishap, trace their actual or potential paths, and evaluate the barriers provided to prevent unwanted energy transfer.

(1) Energy is of two basic classes which can exist in systems in many different forms.

(a) Kinetic energy is that which is present in moving objects such as wind, waves, rotating machinery, falling objects, etc.

(b) Potential energy is stored energy with the capacity to do work or cause change. Types include: chemical; thermal; electrical; ionizing/non-ionizing radiation; acoustic; and biological.

(2) Barriers are established to control energy and are used in several ways. Barriers may be physical, such as machinery guards and protective clothing, or they may be non-physical, such as written directives and established procedures. Typical barriers:

(a) Limit the energy buildup or substitute a safer form (e.g. speed limitations, bilge dewatering, pressure relief valves, circuit breakers, height or weight restrictions, limited quantities of hazardous materials, reduced voltage or pressure, replacement of hazardous chemicals, etc.)

(b) Prevent energy buildup (e.g. grounding of static electricity, ventilation, discarding dated perishable food, etc.)

15. c. (2) (c) Prevent energy release (e.g. hold-down gripes, containment structures, interlock devices, safety harnesses, lock-wiring critical components, tag-out system, two-valve protection, etc.)
- (d) Provide for slow energy release (e.g. pressure reducing/regulating valves, limited exposure time, shock absorption, padding, etc.)
- (e) Channel the release away (e.g. electrical ground wire, exhaust piping, exhaust ventilation, heat exchanger, etc.)
- (f) Use a physical barrier on the energy source (e.g. electrical insulation, thermal insulation, acid-proof containers, etc.)
- (g) Place a physical barrier between the source of energy and people or equipment (e.g. bulkheads, lifelines, distance, separation of time, spray shields, etc.)
- (h) Use a physical barrier on the people or equipment (e.g. hardhat, respirator, heat protective gloves, ear plugs, machinery guards, double insulation, etc.)
- (i) Increase the injury or damage threshold (e.g. exercise, callused hands, etc.)
- (j) Treat the persons or repair equipment (e.g. render first aid, repair flat tire, replace damaged parts, etc.)
- (k) Rehabilitate (i.e. physical therapy, etc.)
- (3) To use the barrier analysis technique, you should make a list of all potential energy transfers and the barriers needed to minimize the risk of loss. Then think about which barriers were missing, inadequate, or not used. Don't limit your thinking to the obvious barriers, such as personal protective equipment and safety devices. Think about the entire chain of barriers and if they were adequate, such as personnel training, continued re-enforcement of standards through leadership and example, and practical standards and established procedures. Once missing or ineffective barriers are identified, necessary remedial actions will become more apparent.
- d. Time Line. In this method all events related to a mishap are sequentially listed on a time-line chart in the order of the time of their occurrence. Simultaneous events may be recorded on separate, parallel time lines for

15. d. (cont'd) comparative purposes. A variation of this method is to write each event on individual index cards and arrange them in correct sequence. Through careful construction and study of a time line, any gaps in the sequence of events will become apparent; these represent unanswered questions that should prompt further investigation. It is generally best to start the timeline with the actual mishap and regress backward until all significant causal factors have been identified. A thorough time-line chart can be very lengthy; fanfold computer paper works well for this purpose.
- e. Flow Chart Analysis. A well designed flow chart provides a logical, guided sequence to an accident investigation and helps to ensure a thorough analysis.
- (1) One popular flow chart analysis method is called MORT, which stands for Management Oversight and Risk Tree. This is a very comprehensive analysis system developed at the Idaho National Engineering Laboratory. MORT relies on a complex flow chart which makes it difficult to use without special training. It is, therefore, not recommended for minor mishap investigations. Limited training with MORT is available through the Naval Safety Center's Accident Investigation course and other sources. Commandant (G-KSE) can provide information on other MORT training sources.
- (2) Appendix C contains a simple flowchart to assist with vessel and firearm mishap investigations. It is intended as a guide to address the basic steps to follow after a mishap, but it should not be used as the only tool for mishap analysis.

TELEPHONE NUMBERS FOR MISHAP REPORTING AND ASSISTANCE

COMMANDANT (G-KSE) SAFETY AND ENVIRONMENTAL HEALTH DIVISION General Assistance Mon-Fri 0700-1700 EST	VOICE (202) 267-1883 FAX (202) 267-4355
COMMANDANT (G-KSE-4) VESSEL SAFETY BRANCH Cutter/Small Boat/Firearm Mishaps Mon-Fri 0700-1700 EST	VOICE (202) 267-2964 FAX (202) 267-4355
COMMANDANT (G-KSE-1) AVIATION SAFETY BRANCH Aviation Mishaps Mon-Fri 0700-1700 EST	VOICE (202) 267-2972 FAX (202) 267-4355
COMMANDANT (G-KSE-2) FACILITY SAFETY BRANCH Shore Facility Mishaps Mon-Fri 0700-1700 EST	VOICE (202) 267-2962 FAX (202) 267-4355
FLAG PLOT, COAST GUARD HEADQUARTERS All Mishap types- Vessel/Facility/Aviation 24 Hours- 7 Days/Week	VOICE (202) 267-2100
MLCLANT (KSP), SAFETY PROGRAMS BRANCH	VOICE (212) 664-7156 FAX (212) 664-3446
MLCPAC (KSE), SAFETY & ENV. HEALTH BRANCH	VOICE (415) 536-5928 FAX (415) 536-5805
CG YARD, SAFETY & OCCUP. HEALTH MGR.	VOICE (410) 636-3772 FAX (410) 636-3779



# INVESTIGATION DISTINCTIONS

	M5100.47 MISHAP INVSTN.	M5830.1 ADMIN. INVSTN.	NTSB INVSTN.
Witness Sworn?	No	Maybe(1)	Maybe(1)
Accompanied by Lawyer?	No(2)	Optional	Optional
Statement Released?	No	Yes	Yes(3)
Manual for Court-Martial Rules of Evidence Apply?	No	Yes	No(3)
Analysis Released?	No	No	Yes(4)
Findings Released?	No	Yes	Yes
Military Compelled to Appear?	Yes	Yes(5)	Yes(5)
Military Compelled to Testify?	No	No	No
Civilian Compelled to Appear?	No	No	Yes(5)
Civilian Compelled to Testify?	No	No	No
Manufacturer Compelled to Appear?	No	No	Yes(5)
Manufacturer Participates?	Yes(6)	Yes	Yes(6)
Manufacturer's Input Released?	Maybe(7)	Yes	Yes(3)
Report Admissible in Court?	No(8)	Yes	No(3)

## NOTES:

(1) Witnesses at formal Boards of Inquiry and NTSB public hearings are always sworn. During informal/field investigations they are usually not sworn, but may be sworn under special circumstances.

(2) Non-Coast Guard witnesses cannot be compelled to testify- they may insist on representation as a condition of appearance.

(3) By law, no part of an NTSB report may be introduced as evidence in a court of law. However, transcripts of NTSB reports are available to the public.

(4) Analysis of individual NTSB investigators is withheld under exemption 5 of the Freedom of Information Act.

(5) Formal Boards of Inquiry and the NTSB have subpoena authority.

(6) With approval of the senior member.

(7) Factual information becomes real evidence and may be released. Opinions expressed by manufacturers under a cover of privilege may be withheld from release.

(8) Safety Investigations are internal Coast Guard documents and are used for internal purposes only. Because the Mishap Analysis Reports are for internal use only, and because they are conducted without the designation of parties, they may not be used as discovery vehicles in UCMJ or other legal proceedings.





## MISHAP INVESTIGATION REFERENCES

The following references stipulate general vessel safety program requirements and reporting procedures. They also explain the legal aspects of mishap investigations. Obviously, other references and records which pertain to each mishap must be consulted to determine specific program requirements.

### Safety and Environmental Health Manual, COMDTINST M5100.47(Series)

- Generally defines Coast Guard safety program.
- Defines mishap classifications.
- Details reporting requirements.
- Specifies mishap investigation types and when required.
- Requires the following caveat statement to be stamped on all mishap reports:

OFFICIAL USE ONLY  
SPECIAL HANDLING REQUIRED  
IN ACCORDANCE WITH  
COMDTINST M5100.47(Series)

### Small Arms Manual, COMDTINST M8370.11(Series)

- Provides criteria for classifying and reporting Firearm-related mishaps.

### Administrative Investigations Manual, COMDTINST M5830.1(Series)

- Defines distinction between mishap safety investigations and administrative investigations.
- Addresses handling of privileged testimony.
- Addresses conflicts of interest between Mishap Analysis investigations and Administrative investigations.
- Prohibits membership on both safety and legal fact-finding investigation boards.
- Identifies related reports that may be required in the event of a mishap, and references governing directive.

### Personnel Manual, COMDTINST M1000.6(Series)

- Lists reporting procedures for certain casualties.

### Unit Safety and Occupational Health Program, COMDTINST 5100.44(Series)

- Stipulates policy for implementation of unit safety programs.

### Medical Manual, COMDTINST M6000.1(Series)

- Provides standards for conducting medical examinations.
- Contains information about decedent affairs.
- Details Occupational Medical Monitoring Program (OMMP).

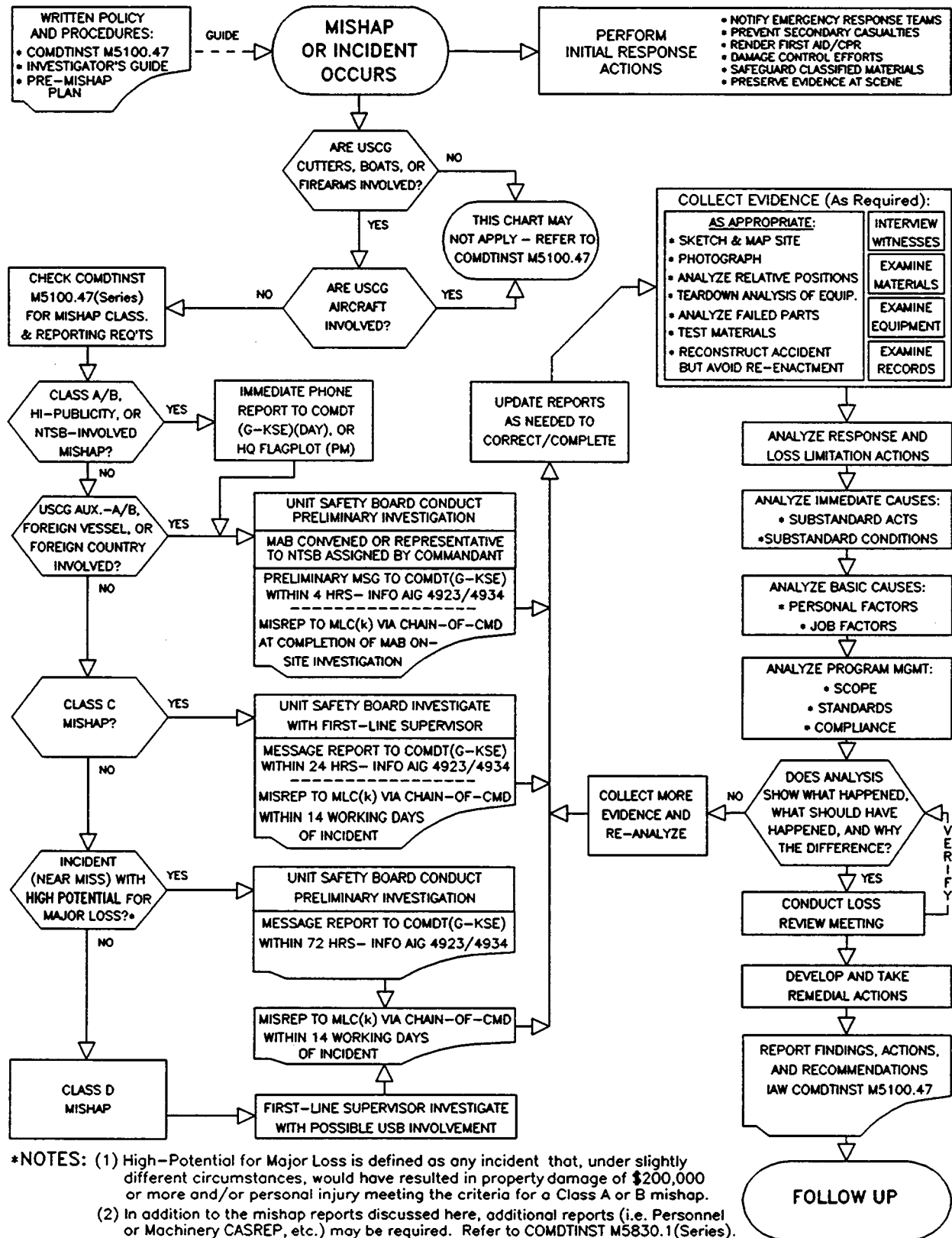
### Pre-Mishap Plan

- Addresses unit organizational responsibilities.
- Specifies minimum safety training requirements.
- Identifies programs to reduce the occurrence of mishaps.
- Specifies local mishap reporting chain-of-command.

Pre-Mishap Plan (cont'd)

- Identifies available resources for assistance with safety program and mishap abatement.
- Discusses pre-staged accident investigation kit.
- Identifies general post-mishap procedures in order to minimize confusion.

# MISHAP/INCIDENT INVESTIGATION FLOW CHART





## GENERAL INVESTIGATIVE CHECKLIST

The completion of mishap reports requires that certain information be obtained from various records and witnesses. In addition to or in support of those items, certain other checks and verifications should be accomplished to ensure a complete and thorough investigation. A successful investigation is dependent upon early identification of causal factors underlying personnel injury and material damage. The following general checklist contains items that may or may not be applicable for the particular investigation being conducted. Additional checklists follow this appendix for further use with specific mishap types.

1. Identify Loss and/or Potential Loss (List all items).
  - a. Harm to people (Personnel casualties).
  - b. Damage to property (Material & Labor costs).
  - c. Loss to process (Degraded mission capability).
2. Personnel.
  - a. Allowance? Manning level? Stability?
  - b. General personnel appearance; safety hazards?
  - c. Injury/Death; Personnel Casualty Report required?
3. Equipment.
  - a. Does equipment involved have a history of failures?
  - b. Is equipment of proper design? Jury-rigged?
  - c. Is it in CALMS? Open purchase? Substitute?
  - d. Operating instructions complete?
  - e. Safety precautions adequate?
  - f. Properly labelled- Compartments, Piping, Ducts, etc.?
  - g. Piping systems adequate?
  - h. Is PMS coverage adequate? Documented?
  - i. Were clocks synchronized? Was a time check log maintained? If appropriate, make time check in affected spaces.
  - j. Communication circuits adequate- 1MC and other intercom systems, sound-powered phones?

3. 1. Firefighting/Damage Control equipment and techniques used to control or reduce damage- Operative? Inoperative? Effective? Ineffective? Why?
4. Location of mishap (where most damage occurred):
  - a. Compartment number.
  - b. Compartment noun name.
  - c. In what compartment did primary mishap cause occur?
5. Logs, records and reports- Review and check for corrective action/contemplated.
  - a. Deck log.
  - b. Sonar logs.
  - c. Watch, Quarter and Station Bill.
  - d. Navigation charts/records.
  - e. Engineering smooth log.
  - f. Engineering bell book.
  - g. Engineering operating logs.
  - h. Damage Control closure log.
  - i. Tagout log.
  - j. Standing orders (CO's/EO's/Dept.)
  - k. Night/Morning orders (CO's/XO's/EO's, etc.)
  - l. Training records: Shipboard, Plan of the Day, Team, PQS, JQR, Equipment Qualification, Individual personnel etc.
  - m. Radio log.
  - n. PDR's
  - o. Ship's operating schedule.
  - p. Inspection reports/trials.
  - q. Machinery/Hull History.
  - r. Significant outstanding CASREPs.
  5. s. Machinery OOC log.
  - t. DC fitting OOC log.

5. u. Were ship's procedures adequate? Followed?
6. Morale.
  - a. Liberty, Leave.
  - b. Number of duty sections/watch sections.
  - c. Working hours, as indicated in P.O.D. and deck logs.
  - d. Habitability- Air conditioning, ventilation, laundry facilities, lighting system, general housekeeping, heads, living quarters, working spaces, recreational spaces.
7. Condition of ship's boats.
8. Availability of shore services.
  - a. Electricity.
  - b. Shore steam.
  - c. Potable and firefighting water.
  - d. HP/LP air.
9. Illumination.
  - a. Exterior.
  - b. Interior.
  - c. At scene.
10. Full description of damage sustained to ship and equipment, including:
  - a. Material costs to Coast Guard.
  - b. Coast Guard man-hours to repair damage.
  - c. Off-ship labor costs.
  - d. Outside assistance costs (drydock, tech. rep., etc.)
11. Primary contributing causes.





## INVESTIGATIVE CHECKLIST FOR FIRES

1. Items to consider in addition to required message reports and general checkoff list are:
  - a. Location of fire.
    - (1) Compartment noun name: Announced/labeled/actual.
    - (2) Compartment number: Announced/labeled/actual.
  - b. Class of fire (A-B-C-D).
  - c. Time fire detected.
  - d. Means of detection.
  - e. Time fire started (estimated).
  - f. Time fire/smoke reported.
  - g. Accuracy of initial and subsequent reports/announcements.
  - h. Time alarm sounded/location announced.
  - i. Time actual fire located.
  - j. Time started fighting fire.
2. Additional information which is required for analysis.
  - a. Time fire boundaries set (reported vs. actual).
  - b. Time smoke boundaries set (reported vs. actual).
  - c. Effectiveness of fire/smoke boundaries.
    - (1) Location.
    - (2) Proper equipment used.
    - (3) Adequate isolation of access closures, mechanical, electrical, fuel/air piping, etc.
    - (4) Boundaries maintained.
  - d. Time fire extinguished.
  - e. Fire did/did not reflash.
  - f. Extinguishing agents used and effectiveness.
    - (1) Firemain water.

2. f. (2) AFFF hoseline from in-line proportioner.
  - (3) Installed AFFF system (AFFF bilge sprinkler, etc.)
  - (4) CO2 (Portable/Installed).
  - (5) PKP/Dry chemical.
  - (6) Steam smothering.
  - (7) Flooding/Sprinkling.
  - (8) Twin-Agent.
  - (9) HALON.
  - (10) Other.
- g. Extinguishing equipment (availability and operability).
  - (1) Pumps (portable/installed) size and quantity.
  - (2) Nozzles/applicators.
  - (3) Foam making devices.
  - (4) Vehicles.
  - (5) Eductors.
  - (6) Type and size of hoses.
  - (7) Other.
- h. Firefighting organization used.
  - (1) At-sea fire party (Flying Squad).
  - (2) Inport fire party.
  - (3) Repair Party (Condition I or II).
  - (4) Other individual/group effort.
  - (5) Outside assistance (explain).
- i. Protective equipment used (availability/operability).
  - (1) OBAs.
  - (2) EEBDs.
  - (3) SCBA (Air Pack).

- 2. i. (4) Firefighting ensemble.
  - (5) Fire retardant coveralls.
  - (6) Boots.
  - (7) Gloves.
  - (8) Helmets.
  - (9) Other.
- j. Alarm systems.
  - (1) CO2 flooding.
  - (2) High temperature.
  - (3) Smoke detector.
  - (4) Other.
- k. Fire contained/spread.
- l. How spread.
  - (1) Through hot deck/bulkhead (conduction).
  - (2) Through hole in deck/bulkhead.
  - (3) By explosion (type).
  - (4) Through vent ducts (convection).
  - (5) By liquid flow.
  - (6) By wind.
  - (7) Through wireways.
  - (8) Other.
- m. Was electric power in area secured?
- n. Was Jettison Bill:
  - (1) Current?
  - (2) Used?
- o. If ship underway, was course changed?
- p. Did vent closures work?

2. q. Were magazines flooded?
- r. Operational problems.
- (1) OBAs/canisters effective.
  - (2) EEBDs effective.
  - (3) Sufficient water pressure.
  - (4) Flooding problems.
  - (5) Drainage problems (installed/portable).
  - (6) Desmoking problems (installed/portable).
  - (7) Lighting problems.
  - (8) Adequate equipment readily available.
  - (9) Adequate intra-ship communications.
  - (10) Other- explain.
- s. Material discrepancies of any equipment used (list & explain).
- t. Determine all possible heat/ignition sources, then eliminate those that are improbable.

INVESTIGATIVE CHECKLIST FOR NON-ORDNANCE EXPLOSIONS

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Location of explosion.
    - (1) Compartment noun name: Announced/labeled/actual.
    - (2) Compartment number: Announced/labeled/actual.
  - b. Type of explosion.
    - (1) Compressed gas/air.
    - (2) Flammable vapor/gas.
    - (3) Pressure vessel (i.e. boiler) rupture.
    - (4) Fuels, oils, lubricants.
    - (5) Dusts.
  - c. Cause of explosion.
    - (1) Violation of safety precautions/operating procedures.
    - (2) Equipment- Material failure or malfunction.
    - (3) Personnel error (other than procedural violations).
    - (4) Other.
  - d. Effects of explosion (use appropriate checklist(s)).
    - (1) Fire.
    - (2) Flooding, including steam release.
    - (3) Personnel casualties.
    - (4) Other effects.



## INVESTIGATIVE CHECKLIST FOR FLOODING

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Location of flooding.
    - (1) Compartment noun name: Announced/Labeled/Actual.
    - (2) Compartment number: Announced/Labeled/Actual.
  - b. Type of flooding (fresh/salt water, oil, JP5, etc.).
  - c. Source of flooding (internal or external).
    - (1) Pipe rupture or valve failure.
    - (2) Tank rupture/hull rupture/shaft seal failure.
    - (3) Open to sea through designed hull penetration.
    - (4) Other.
  - d. Time flooding was detected/reported/alarm sounded.
  - e. How was flooding detected?
  - f. Time space was last inspected prior to flooding.
  - g. Time flooding was stopped or under control.
  - h. Time required to dewater.
  - i. Dewatering equipment used- Effective/Available/Operative?
  - j. Cause of flooding.
  - k. Time to set flooding boundaries (ordered, reported set).
  - l. Effectiveness of flooding boundaries.
  - m. Amount of flooding.
    - (1) Effect on list, trim, and stability.
  - n. Damage (list all items).
    - (1) Material costs.
    - (2) Labor costs.
    - (3) Outside assistance costs.





## INVESTIGATIVE CHECKLIST FOR COLLISION

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Tactical condition existing at time of collision.
  - b. Personnel manning and qualification.
    - (1) CO.
    - (2) XO.
    - (3) OOD.
    - (4) Helmsman.
    - (5) Navigator.
    - (6) Lookouts.
    - (7) Bearing takers.
    - (8) Local pilot.
    - (9) CIC teams.
    - (10) Phone talkers.
    - (11) Line handlers.
    - (12) Location of Conning Officer/OOD.
    - (13) Who really had the Conn? Was he/she in fact controlling all the forces acting on the ship?
  - c. Material factors.
    - (1) Radar.
    - (2) Sonar.
    - (3) Navigational lights.
    - (4) Compasses.
    - (5) Ship control systems.
    - (6) UNREP special equipment.
  - d. Communications factors.
    - (1) Radio.

1. d. (2) Telephone.
  - (3) Oral (audibility/understanding).
  - (4) Signal systems.
  - (5) Interferences (e.g. background noise level).
- e. Rules of the road factors.
- f. Operating area factors.
  - (1) Adherence to OPAREA boundaries.
  - (2) Existence of safety lanes.
  - (3) Draft vs. charted depths.
- g. Environment and visibility.
- h. Unique local practices.
- i. Assistance factors.
  - (1) Pilot.
  - (2) Tugs.
  - (3) Line handlers.
- j. For collisions in restricted waters or with fixed geographic features, including buoys, refer also to the checklist for groundings.

## INVESTIGATIVE CHECKLIST FOR GROUNDING

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Tactical situation.
  - b. Personnel factors (posted/qualified).
    - (1) CO.
    - (2) XO.
    - (3) OOD.
    - (4) Helmsman.
    - (5) Navigator.
    - (6) Lookouts.
    - (7) Bearing takers.
    - (8) Local pilot.
    - (9) CIC teams.
    - (10) Phone talkers.
    - (11) Line handlers.
    - (12) Fathometer operator.
    - (13) Leadsman.
    - (14) Location of Conning Officer/OOD.
    - (15) Who really had the Conn? Was he/she in fact controlling all the forces acting on the ship?
  - c. Navigational factors.
    - (1) Charts (available/correct/in use).
    - (2) Sailing directions/coast plot.
    - (3) Fleet guide.
    - (4) Tide/current condition- computed/displayed/recorded.
    - (5) Track laid out/fixes plotted/track projected, etc.
    - (6) Notices to Mariners.

1. c. (7) Compass errors/application.  
(8) Navigation fix errors & reset errors.  
(9) Depth of water.  
(10) Type of bottom.  
(11) Navigation reference points coordinated. Radar/  
visual points logged? Plotting teams coordinated?
- d. Material factors.  
(1) Radar.  
(2) Fathometer.  
(3) Compasses.  
(4) Ship's speed.  
(5) Alidades, bearing circles, bearing repeaters, etc.  
(6) Sounding lead.  
(7) Ship's draft.  
(8) Ship's anchor.  
(9) Ship control systems.
- e. Communications factors.  
(1) Radio.  
(2) Telephone.  
(3) IC systems.  
(4) Oral- audibility/understanding.
- f. Environment.  
(1) Light conditions.  
(2) Visibility.  
(3) Wind, current, tide condition (actual vs. predicted).
- g. Assistance factors.  
(1) Pilot.

1. g. (2) Tugs.
- h. Organizational factors.
  - (1) Ship organization directives.
  - (2) Watch organization directives.



## INVESTIGATIVE CHECKLIST FOR SMALL BOAT MISHAPS

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Checklist for the category of mishap (i.e. fire, flooding, grounding, etc.)
  - b. Material factors.
    - (1) Age of the boat.
    - (2) Condition of hull and machinery.
    - (3) Boat capacity.
    - (4) Maintenance accomplished.
  - c. Personnel factors (manning/qualification).
    - (1) Boat crew.
    - (2) Boat officer.
    - (3) Boat lowering detail.
  - d. Special considerations.
    - (1) Boat power/maneuverability.
    - (2) Navigation facilities/capabilities.
    - (3) Designed operating envelope.
    - (4) Unique design features.





## INVESTIGATIVE CHECKLIST FOR FIREARM/ORDNANCE MISHAPS

### 1. General Weapons Mishaps - Items to consider in addition to required message reports and General checkoff list are:

#### a. Resulting damage (Loss).

- (1) Harm to people: Military/civilian.
- (2) Damage to property.
- (3) Harm to environment.
- (4) Degraded mission capability.

Note: For an unexpected weapons discharge or incident where no damage or loss occurred, consider the potential for serious damage.

#### b. Location of mishap or incident.

- (1) Compartment noun name: Announced/labeled/actual.
- (2) Compartment number: Announced/labeled/actual.

#### c. Operational procedures.

- (1) Standard procedures: Established/known/followed/adequate?
- (2) Prefire/pre-mission brief.
- (3) Prefire/postfire PMS and inspections.
- (4) Transport/transit/transfer procedures.
- (5) Rules of engagement/threat assessment.
- (6) Loading procedure.
- (7) Firing procedure.
- (8) Misfire procedure.
- (9) Unloading/clearing procedures.
- (10) Security procedures.

#### d. Communications.

- (1) Methods available/used and their effectiveness.

- (2) Use and understanding of standard commands & phraseology.
- (3) Safety placards and operating instructions posted per COMDTINST M8370.11 (Series) and COMDTINST M8000.3 (Series).
- (4) Communication interference/breakdown due to environmental or other factors.

e. Logs and Records.

- (1) Small Arms Log: Firearm transfers/receipts; Daily check/inspection records; PMS history; Casualty history; Corrective maintenance; Rounds fired and ammo lot number.
- (2) Privately Owned Firearms Log: Signed statements of compliance with Small Arms Manual regulations; Weapon descriptions.
- (3) Magazine Log: Ammo stowage history; Magazine inspections; Log keeping instructions.
- (4) Ordnance Log: Used at units with no Gunners Mate assigned as a consolidated Small Arms Log and Magazine Log.
- (5) Unit Log: Record of daily checks of small arms, pyrotechnics, and ammunition.
- (6) Ammunition Stock Record Cards (NAVSUP Form 1296).
- (7) Ammunition Lot/Location Cards (NAVSUP Form 1297).
- (8) Record of Small Arms Training.
- (9) Small Arms Record Firing Reports (CG-3029).
- (10) Judgemental Firing and Qualification records (CG-3029A and CG-3029).
- (11) Small Arms Training Report.
- (12) SPCCINST 8010.12 (Series) reports of accidents, incidents, malfunctions, or dangerously defective items. (Held by Districts, 399' WAGB, WHEC, and WMEC)

f. Safety precautions.

- (1) Personnel Protective Equipment: Available/used/adequate?

- (2) Established precautions used/adequate: Small Arms Manual, COMDTINST M8370.11 (Series); Ordnance Manual, COMDTINST M8000.2A (Series); PMS/JQR IAW COMDTINST M3502.4 (Series).
- g. Material factors.
  - (1) Equipment status.
  - (2) Component defect.
  - (3) Safety devices.
  - (4) Equipment alterations/modifications: Parts added or removed, material substitutions, cannibalized parts, etc.
- h. Personnel factors of all involved, including supervisors, handlers, and victims.
  - (1) Adequately trained/retrained.
  - (2) Qualification/certification for evolution/system.
  - (3) Job experience.
  - (3) General health & fitness- including stress, fatigue, emotional state, and physical condition.
  - (4) Effect of medications or controlled substances.
  - (5) Tempo of operations and mission focus; perceived sense of urgency.
  - (6) Risk assessment.
  - (7) Leadership and administration.
- i. Environmental factors (Degree of exposure, length of exposure, procedural limits).
  - (1) Noise/vibration.
  - (2) Shock.
  - (3) Temperature & humidity.
  - (4) Static charge.
  - (5) Electromagnetic energy-induced charge.
  - (6) Visibility.
  - (7) Motion.

- (8) Distracting activities in progress concurrently.
  - (9) Range conditions.
- j. Emergency preparedness.
  - (1) Pre-mishap plan.
  - (2) Damage containment/control.
  - (3) First aid.
- 2. Ordnance Explosions - In addition to the above checklist, items to consider are:
  - a. Nomenclature/identification of explosive ordnance system and components.
    - (1) Lot number or serial number.
    - (2) Noun name, mark and mod.
    - (3) Naval Ammunition Logistics Code or Department of Defense Identification Code.
    - (4) National stock number (NSN).
    - (5) Main explosive charge.
    - (6) Condition code.
  - b. Launching platform/device.
    - (1) Identification.
    - (2) Mark/mod./serial number.
  - c. Launch platform parameters.
  - d. Fuzing.
    - (1) Fuze parameters set.
    - (2) Fuze setting device.
  - e. Captive flight data.

INVESTIGATIVE CHECKLIST FOR HEAVY WEATHER MISHAPS

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Warning factors (Timeliness/Accuracy/Receipt-routing procedures).
    - (1) Weather reports/forecasts by radio or weather FAX.
    - (2) Onboard weather services and facilities.
    - (3) Utilization of optimum track ship routing (OTSR).
  - b. Operational/tactical situation.
    - (1) Ability to evade.
    - (2) Modification requested.
    - (3) Evasion ordered.
  - c. Heavy weather bill.
    - (1) Written? Up-to date?
    - (2) Implementation.
      - (a) Additional security patrols.
      - (b) Internal stowage rechecked.
      - (c) Special preparations.
  - d. Damage effects.
    - (1) Prevention.
    - (2) Correction.



## INVESTIGATIVE CHECKLIST FOR CARGO/WEIGHT HANDLING MISHAPS

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Personnel Factors.
    - (1) Station manning (adequacy).
    - (2) Fatigue factor.
    - (3) Qualifications (required/attained).
      - (a) Station supervisors.
      - (b) Crane/boom operators.
      - (c) Cargo handlers.
      - (d) Safety supervisor.
    - (4) Injuries (Unit submit Personnel CASREP).
  - b. Material factors.
    - (1) Age of equipment.
    - (2) PMS applicability (Booms, padeyes, rigging, etc.)
    - (3) Test load performance.
    - (4) Rig used (i.e. whip vs. main purchase, slings, etc.)
    - (5) Load capacities vs. load weights.
    - (6) Safety devices and interlocks.
  - c. Extreme environmental factors.
    - (1) Weather.
    - (2) Lighting.
    - (3) Sound levels.
    - (4) Sea conditions.
  - d. Tactical situation (when applicable).
  - e. Cargo characteristics.
    - (1) Unusual size/shape.
    - (2) Weight (as determined before handling).





## INVESTIGATIVE CHECKLIST FOR DECK SEAMANSHIP MISHAPS

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Location of mishap.
    - (1) Frame.
    - (2) Deck.
    - (3) Side.
  - b. Personnel factors (manning/qualifications).
    - (1) Supervisors.
    - (2) Operators.
    - (3) Safety observers.
  - c. Material factors.
    - (1) Equipment properly maintained.
    - (2) Test data.
    - (3) Type of construction and material.
    - (4) Unusual features.
    - (5) Jury rigs?
  - d. Environmental factors.
    - (1) Weather.
    - (2) Lighting.
    - (3) Sea Conditions.
    - (4) Clutter of working space.
  - e. Procedural pre-brief.
    - (1) Evolution pre-brief.
    - (2) Personal protective equipment.



## INVESTIGATIVE CHECKLIST FOR SHIP CONTROL MISHAPS

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Material factors.
    - (1) Equipment history.
    - (2) Machinery/equipment design.
    - (3) Operability of alarm/indication systems.
    - (4) Watch station/equipment arrangements.
    - (5) PMS accomplished?
  - b. Personnel factors.
    - (1) Operator qualification/experience.
    - (2) Watchstander comfort/confusion factors.
  - c. Environmental factors.
    - (1) Noise.
    - (2) Temperature.
    - (3) Lighting.
    - (4) Tide/Current.
    - (5) Wind.
  - d. Tactical situation.
  - e. Actions to prevent mishaps arising from the loss of propulsion/steerage.



## INVESTIGATIVE CHECKLIST FOR MATERIAL FAILURE/MALFUNCTION MISHAPS

**NOTE:** Investigators must critically examine a mishap appearing to fit this class. The mishap may, in fact, fit in another category, with material failure/malfunction as a causal factor.

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Location of mishap.
    - (1) Compartment name/identification.
    - (2) Equipment, system, component.
  - b. Detailed description of failure.
    - (1) Type of material.
    - (2) Nature of failure.
    - (3) Sequence of events.
  - c. Ship's operation and mission at time of mishap.
  - d. Equipment of system and condition at time of mishap.
    - (1) Outstanding related CASREPs.
    - (2) Actual parameters vs. design parameters.
    - (3) Tech manual/operating procedures available and in use.
    - (4) Historical information (PMS/repairs).
  - e. Personnel factors
    - (1) Training/Qualifications of operators.
    - (2) Training/Qualifications of maintenance personnel.
  - f. Actions taken to prevent another mishap.



## INVESTIGATIVE CHECKLIST FOR PERSONNEL MISHAPS/INJURIES

1. Items to consider in addition to required message reports and General checkoff list are:
  - a. Identifying data.
    - (1) Injured person's full name.
    - (2) Sex/age.
    - (3) USCG/USCGR/Civilian.
    - (4) Rate/Rank/Civilian occupation.
    - (5) Military service time- relevant experience.
    - (6) Civilian work time- relevant experience.
  - b. Injury status.
    - (1) Kind of injury (burn, laceration, etc.).
    - (2) Body part injured (head, right forearm, etc.).
    - (3) Prognosis.
    - (4) Source of injury/unwanted energy (air pressure, chemicals, fire, etc.).
  - c. Place of occurrence.
    - (1) Aboard ship- specific space/evolution.
    - (2) Ashore- specific place.
  - d. Man-days lost- helps determine mishap class.
  - e. Training adequacy.
    - (1) Formal/on-the-job.
    - (2) Shipboard/team.
    - (3) Transition- Equipment/procedures.
    - (4) Emergency responses/reaction time.
    - (5) Engaged in tasks too difficult for skill level.
    - (6) Engaged in tasks different than those in which trained.

1. f. Supervision.

(1) Adequate/lax.

(2) Absent.

g. Physical factors- was/were the injured person(s):

(1) Tired/chronically fatigued?

(2) Working excessive hours?

(3) Engaged in physically demanding duties like loading stores?

(4) Under the influence of alcohol/controlled substance?  
(Medical tests conducted?)

(5) Suffering from a hangover?

(6) Taking medication, either prescribed or unauthorized?

(7) Ill or experiencing dizziness, headaches, or nausea?

(8) Hungry due to dieting or missed meals?

(9) Suffering from exposure to severe environmental extremes (excessive heat, humidity, etc.)?

h. Mental factors- was/were the injured person(s):

(1) Emotionally upset (angry, depressed, tense, etc.)?

(2) Inattentive to duties due to preoccupation with unrelated matters such as marital difficulties?

(3) Confident about his ability to complete the job?

(4) Interested/motivated in the work he/she was doing?

(5) Knowledgeable of standard procedures and adhering to them.

(6) Using jury-rigged equipment and short-cutting routine procedures?

(7) Not experienced enough for the task assigned?

(8) In need of more supervision?

(9) Engaged in horseplay without regard for personal safety or the safety of others?

(10) Recently involved in other accidents?



1. h. (11) A disciplinary problem?
- i. Design factors- was/were the injured person(s):
  - (1) Operating defective equipment?
  - (2) Operating unfamiliar equipment/controls?
  - (3) Operating equipment with controls that functioned differently than expected due to lack of standardization?
  - (4) Operating equipment from a remote station which precluded observation of results?
  - (5) Having difficulty reading the displays because of obstructions or clutter?
  - (6) Having difficulty activating controls because of restriction or unavailability of special tools?
  - (7) Unable to respond rapidly due to inaccessibility of emergency devices?
  - (8) Overburdened (saturated) by the requirement to make too many control movements/decisions in a limited time period?
  - (9) Hampered by a poorly arranged work space?
  - (10) Unable to reach all controls from his/her work station and see/hear all displays, signals, and communications?
  - (11) Using insufficient or inadequate support/tech manuals?
  - (12) Using support equipment which was not clearly identified and likely to be confused with similar but incompatible equipment?
- j. Environmental factors- was the injured person:
  - (1) Exposed to harmful dusts, fumes or gases without proper ventilation or respiratory protection?
  - (2) Working in a hazardous environment without personal protective equipment or standby rescue personnel?
  - (3) Unable to see/hear all communications and signals?
  - (4) Exposed to temperature extremes that could reduce efficiency or cause faintness, heat stroke, or numbness?

1. j. (5) Suffering from eye fatigue due to glare or inadequate illumination?
- (6) Visually restricted by dense fog, rain, smoke, or snow?
- (7) Working in Darken Ship conditions?
- (8) Exposed to excessive noise/vibration levels?
- k. Personnel protective equipment- was the injured person:
  - (1) Using all equipment required for the job? (Identify in detail)
  - (2) Not using proper equipment due to lack of availability/discomfort/inconvenience?
  - (3) Using PPE that failed or caused additional injuries?
1. Hazardous conditions- was the person injured from:
  - (1) Inadequate/missing guards, hand rail, deck plate, ladder treads, protective mats, safety devices/switches, non-skid, etc.?
  - (2) Jury-rigged equipment?
  - (3) Use of improper or non-insulated tools?
  - (4) Incorrectly installed equipment?
  - (5) Defective or improperly maintained equipment?
  - (6) Slippery decks or ladders, obstructions?
  - (7) Improper clothing (leather heels, non-safety shoes, loose fitting clothes, no shirt, non-safety glasses, etc.)?



